

Analysis of Civil, Architectural and Urban Planning of Passive Defense: A Case Study in Central Library of Tabriz

Ali Pourzangbar^{1*}, Anise Saaber Qaraamaleki², Mohammad Barzegar³, Saeid Johari⁴, Qolaamreza Alipour⁵, Arash Valizade⁶, Javaad Qasami⁶, Nasim Seraat Nouri⁷, Behnam Lotfi²

¹MSc in Civil Engineering, Azarpaay Hydraulic Devises Company; ²BSc in Architecture, Nabi Akram (pbuh) Higher Education Institute; ³MSc student in Industrial Engineering, Islamic Azad University, Qazvin Branch, Industrial and Mechanic Engineering Faculty; ⁴BSc in Civil Engineering, Technical Engineering Faculty of Marand, Tabriz University; ⁵BSc in Civil Engineering, Islamic Azaad University, Soufian Branch, Soufian, Iran; ⁶BSc in Industrial Engineering, Azarpay Hydraulic Devises Company; ⁷MSc in Criminal Law, Faculty of Law and Political Studies, Tehran University

*E-mail: Pourzangbar.Ali5@Gmail.com

Abstract

Passive defense is a set of unarmed actions for reducing the vulnerability of human resources, facilities and structures in encountering to the explosions and possible threats. Disregarding the necessities of passive defense can lead to the loss of human lives, intensification of the damages to the structures and consequently the consumption of large amounts of finance in facing the possible threats. Therefore, considering these necessities has a special significance. In this study, the amount of observation of these necessities in the central library of Tabriz was analyzed as one of the important structures of the Tabriz city. The results of this study indicate that even by considering the importance of this center, the passive defense necessities in this center have not been observed neither from the structural point of view nor the architecture and nor the foundations. Therefore, the structure of this center, the staff and the people who go there are constant subjects of damage and threat.

Keywords: passive defense, central library of Tabriz, civil necessities, vulnerability

Introduction

Passive defense concentrates on the reduction of the vulnerability of human resources and structures in facing the blast waves and also the multi-task of the structures. In order to reach these goals, the structures aside from being expertly and correctly located with proper architecture, they should be designed professionally and expertly from the standpoint of architecture, civil planning, structure and civil engineering, mechanical and electrical facilities to face the natural disasters like earthquakes. Nine principles that should be observed in passive defense are locating, camouflage, secrecy, covering, deceit, displacement and scattering, dispersion, retrofitting and announcement. Observing these principles in a structure will lead to the reduction of the vulnerability of the structure and facilitation of the crisis management when accidents occur.

The central library of Tabriz is the oldest public library of the East Azerbaijan province after Tarbiat library. With an area of 60000 square meters and a building in an area of 11000 square meters, it is the largest public library of Iran and in terms of books, sources and exquisite manuscripts, it is the largest most rich library of Iran among the public libraries running under the supervision of the country's public libraries institution.

This study tries to analyze the civil, architectural and civil planning necessities of the central library of Tabriz which is frequented by a large number of researchers and college students and also as a place for numerous documents, manuscripts and books. The process of the study is based on field visits, passive defense books and articles and interviewing the experts of this field. The results

of this study indicate that although this center is one of the most important centers of the Tabriz city, yet the necessities of passive defense have not been correctly observed.

Principle of Passive Defense

The principles of passive defense which were mentioned in the introduction lead to the reduction of vulnerability and facilitation of crisis management. Yet still, some of the national projects in Iran lack these passive defense necessities. For instance, an analysis of Shahid Salimi power plant in Neka in 1998 indicated that although, this center is one of the most sensitive and vital centers of the country, it still is very vulnerable from the standpoint of the factors of passive defense against air strikes and the threats of the enemy. Also, among the incorrect locations of Tabriz can be pointed to the Petrochemicals, Soungoun's copper mine in East Azerbaijan province and other industrial centers in Tabriz and other big cities around the country. Among the correct locating the Pyung Yang subway in North Korea can be mentioned which has special significance for this country at the time of the occurrence of threats and accidents.

As it was mentioned previously, one of the principles of passive defense is to build resistant structures and shelters. Regarding shelters and based on calculations done by the civil defense organization in Switzerland, at the time of the explosion of an atomic bomb with a 20 kilo tons power in the center of the city, if all the people were in the shelters, the number of the casualties will be 24000 deaths and 7000 injuries. While if the same explosion took place when there were no shelters, there would be 70000 deaths.

Therefore, the observation of the principles of passive defense in the national projects that are in studying stage, as they are mentioned in the 21 subject of national construction rules and article 215 of the fifth five years development plan, has special significance. Also, finished projects can be fixed to a large extent through the identification of the items that do not match the principles of passive defense and by spending trivial amounts of finance. Based on this, the amount of the observation of the principals of passive defense in the central library of Tabriz as one of the most important capital and sheltering centers for the people has been studied and matching and non-matching items with the principals of the passive defense have been mentioned.

Necessities of Passive Defense in Central Library of Tabriz

In this part, the structural and space system, mechanical and electrical facilities, architecture and civil planning of the central library of Tabriz are analyzed from the standpoint of passive defense.

Structural system, partitions and segregating elements, exterior look and the ceiling of the central library of Tabriz

According to the notions of passive defense and the 21st subject of national construction rules and also based on the studies, it has been indicated that a building with concrete skeleton have the highest amount of coordination with the goals of the passive defense and also the highest resistance toward blast waves. Also, the kind of the exterior walls that are resilient against blast waves is cement, clay and concrete. Although, the facade of the building should be made of composite, cement or marble in order to decrease the effects of blast waves and to confront fire incidents, it is not proper and it does not match the principles of passive defense because of the lack of flexibility and proper lifting of the debris. The proper ceiling system for passive defense is block joist and reinforced concrete slab. In order to the important structures to have a camouflage designing, it is better to use green ceilings that are also efficient in terms of energy. In non-carrying septum the elements like walls, ceiling and false floors, cutting material such as glass and heavy tools should not be used in the ceiling.

The structural system of the central library of Tabriz is in the form of a concrete skeleton and is in a flexural pane type. Also, the ceiling of this center is done in the reinforced concrete slab form and in most parts it is covered with yarn false ceiling (Figures 1 and 2). As it is shown in figure 7, this center's ceiling is done in a concrete slab type and the ceiling is yarn false ceiling and added to its lightness and capability it has fast execution and resistance against fire and a good space for the mechanical facilities and sound systems and the exterior walls of this building are from marble. Also in figure 3, the exterior plan of the central library building is shown which is made of marble and although, it has proper resilience against blast waves and fires, as its debris can not be lifted quickly and its restoration capability is not very desirable in terms of passive defense.

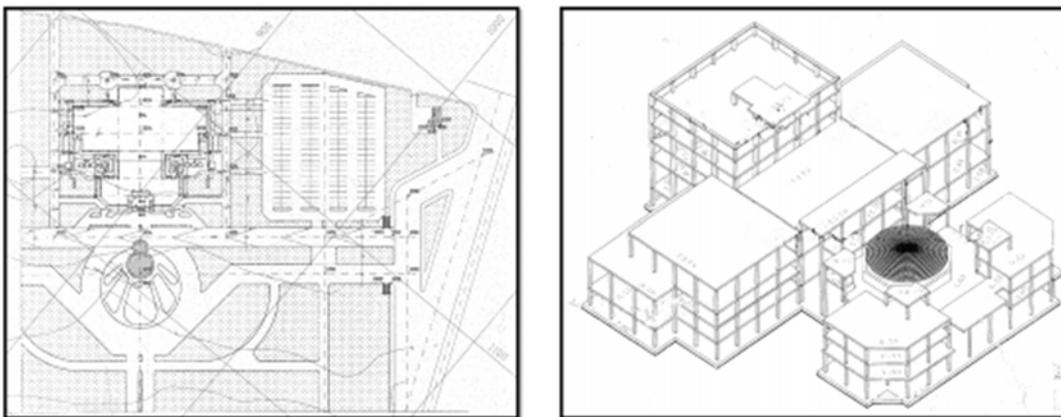


Figure 1. Site plan and the third volume of the central library of Tabriz

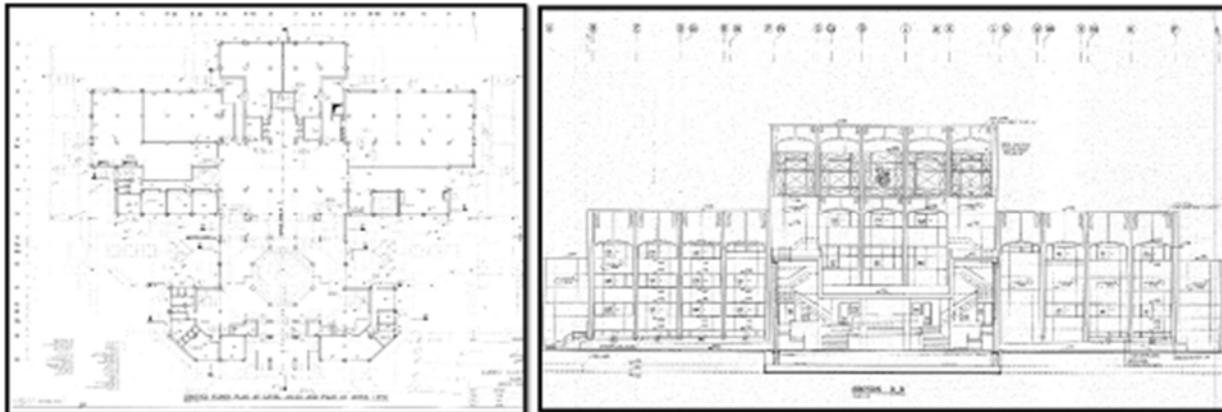


Figure 2. First floor plan of the central library of Tabriz

The type of the exterior walls in this center is clay block walls which are proper from the view point of passive defense. Also, in this center, glass elements are used for segregating the spaces in the study room, the internet space, registration room and some other partitions which are not in coordination with passive defense (Figure 4).

In the entrance of this center chandeliers and a big clock are hanged from the ceiling which lacks the necessities of passive defense. Also, according to the necessities of passive defense, it is better to use a few internal decorations and added elements as much as possible or in case of using internal decorations like statues they should be constrained in the best possible way. In this center, it seems that these items are not observed correctly (Figure 5).

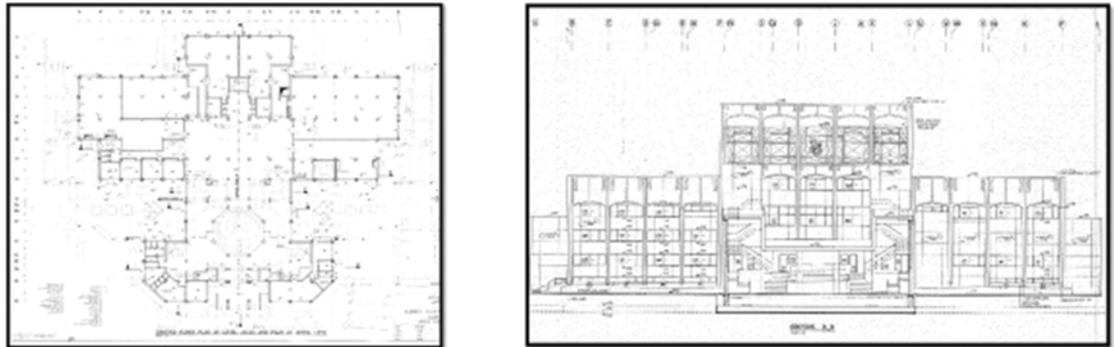


Figure 3. The type of the false ceiling and appearance of the exterior walls of the central library of Tabriz

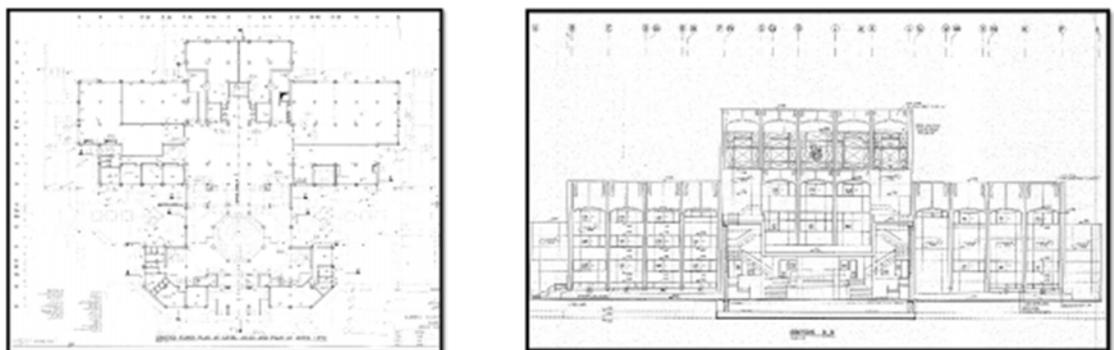


Figure 4. Segregating the internal spaces by using glass elements in the central library of Tabriz

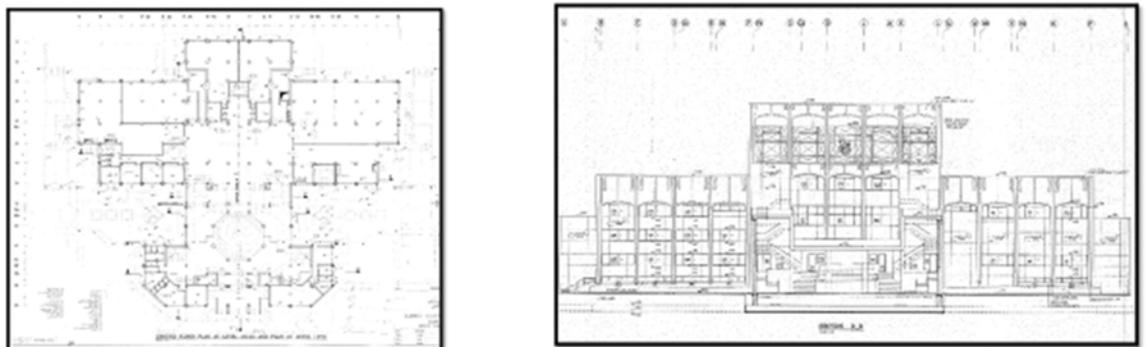


Figure 5. The utilization of hanging elements and unconstrained internal decorations in the internal space of the central library of Tabriz

The Architecture of the Central Library of Tabriz

From the view point of passive defense, the desired form of architecture is in a way that it has the least amount of resilience against blast waves. Based on this, if the form of the building to be conical or semicircular, it is the most desired form and if it to be cubical, it is the most uncoordinated form from the view point of passive defense (Figure 6). The central library has polygenic and cubic forms that are not proper from the standpoint of passive defense (Figure 7). Added to this, the structural form in some parts has steep angles and in these spaces the blast waves have the ability to intensify (Figure 7).

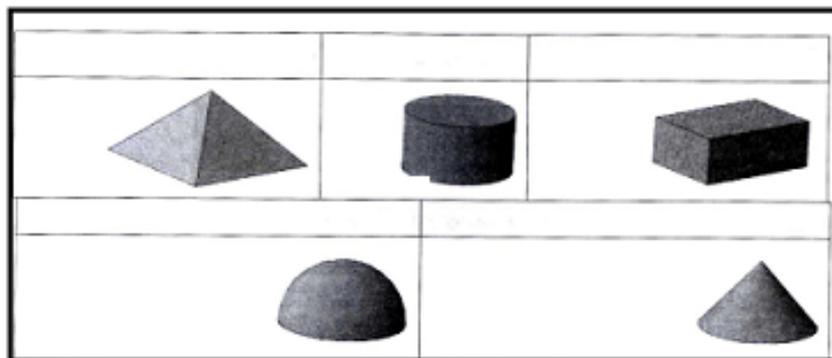


Figure 6. Types of forms of building foundation

The flat ceiling is the most coordinated ceiling with the principles of passive defense, especially if it has had a greenery cover. Added to the principles of camouflage, the subject of energy and the reduction of air pollution will also be considered. In general, as much as the building's plan to be symmetric and without broaches or projections, because of the higher transportation of blast waves and the proper aerodynamic functions, it has more coordination with the principles of passive defense. The central library building has a flat form with an broach exterior in the height of the building which is not desirable from the standpoint of passive defense because of the way it makes the building less aerodynamic and attracts more of the energy from the blast waves even if the amount of these broaches to be trivial (Figure 8).

If the shape and form of the exterior of the building were concave, it had more ability in transforming the blast waves and consequently there will be the least damage to the structure. Also, as much as the building extends more in the ground next to it, there will be less damage caused by explosions because the intensity of the blast wave will give less damage on the building and it will have more coordination with the goals of passive defense. Therefore, it is better to use structures that have few dimensions that are stapled on the ground but are higher and their sensitive parts are located in the underground floors.



Figure 7. The windward and blast wave intensifier angles in the plan for the central library of Tabriz



Figure 8. The bleach in the height of the building of the central library of Tabriz

According to the necessities of the 21st subject of national construction rules and the principles of passive defense in the designing of operable and windows, it is suggested to use small pieces of glass instead of bigger and seamless pieces of glass. Also, the doors should be opened outwardly and it is better to use balconies and the windows to be located inwardly with a little distance from the surface of the wall so that, they would prevent glasses from being thrown to the outside (Figure 9).

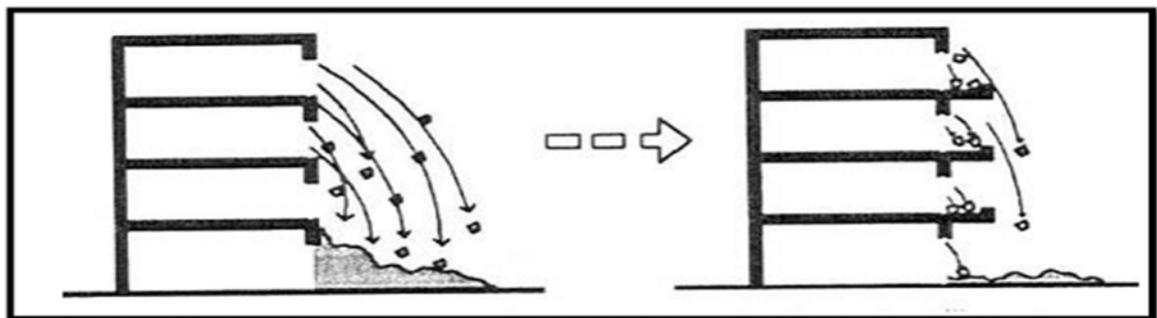


Figure 9. The utilization of balconies or terraces to prevent the throwing of small pieces of glass to the outside space

Although, a balcony is used in the study room of this center and this space can confine the effects resulted from the throwing of pieces of glass, most of these parts have no space for confining the little pieces of glass thrown by blast waves. Added to this, according to the principles of passive defense, it is better for the operable to be dispersed and small while the operable in this center is compressed and large (Figure 10 A). Also, this center has three entrances and only the main entrance's doors can be opened from both sides (Figure 10 B).

It is better to locate operable in the depth of the wall and it is more desirable that the openers' place to be vertical. Also, according to the necessities of passive defense, it is better the lights to come from the ceiling or at least from one of the vertical openers (Figure 11). In this center, the openers are horizontal and the lights also come through the windows located in the higher third of the wall or in the middle, even in the study room of this center which is not in coordination with the goals of passive defense.



Figure 10 A. The lack of enough space for confining the little pieces of glass
Figure 10 B. The main entrance of the central library of Tabriz

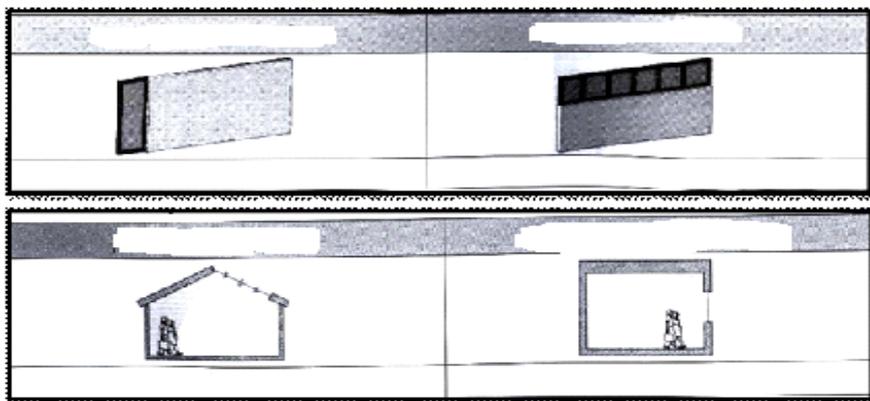


Figure 11. Different kinds of locations for the openers and lighting in coordination with the principles of passive defense



Figure 12. The lighting method in the study room of the central library of Tabriz

According to the necessities of subject 21 from the national rules of construction for preventing the intensification of the effects of the blast waves and creating suction in the space, the designing of spaces with linear plans like long and straight corridors should be avoided. However, the entrance of the central library of Tabriz has a potential space for the penetration of blast waves (Figure 9). Other parts of this center are located in corridors and the way they are put can be in coordination with the principles of passive defense (Figure 17).

Based on the definition of safe space, it is all or parts of a building with multiple functions that through preparations provides the safety and the lives of people in face of threats in the times of peace, and it has conditions like resilience in face of explosions, ease of access to the exits and small entrances. Unfortunately, there is no safe space in this center and there is only one part which has armed concrete walls in which manuscripts are kept and it does not have the capability to hold the public if needed. Therefore, it can be said that although, the central library of Tabriz is the place where several people frequent and work in and with multiple functions in the time of the occurrence of accidents, it lacks the safe space for sheltering in the times of danger.

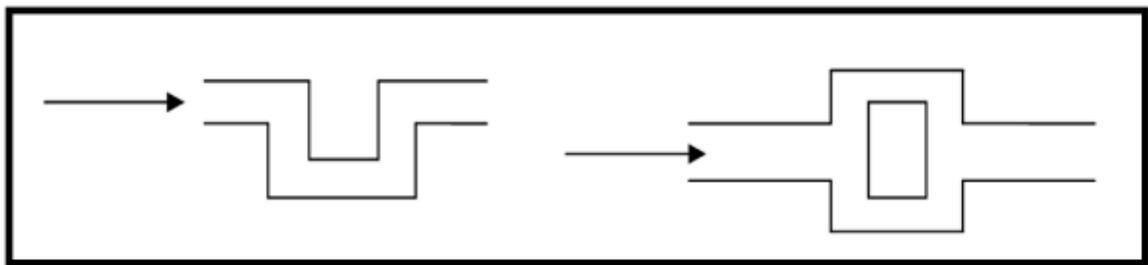


Figure 13. The way to design internal spaces for reducing the effects of the blast wave

From the necessities of passive defense is that added elements should be confined in the possible best way. Whereas in this center, added to the hanging elements from the ceiling, there are also statues that lack enough confinement and book shelves and this may be a threat to the staff at the time of earth quakes and accidents (Figure 14). It was advised that the shelves in this center be chosen in the form of connected shelves so that, they can be saved from the risk of fire and also have enough resilience in the face of the movements of their sides and do not collapse. In figure 15 a staple of these shelves is that how they have proper use for keeping documents and also proper side for confinement. The elevator in this building has no capability for fire extinguishing and smoke depletion and is actually useless in times of crisis and danger (Figure 15).



Figure 14. The unconfined shelves in the central library of Tabriz



Figure 15. The elevator of the central library and proper shelves with high combinability and in coordination with passive defense

The entrance of the building should be designed in a way that added to regular times, could response to the amount of traffic in the time of crisis. Also, these entrances should have the capability to be fixed in case of destruction and the ceilings that are resilient against the fallen debris as much as possible (Figure 16 A). The main entrance of the central library of Tabriz has a ceiling which is recessed and it is executed above ground level (Figure 16 B). The recessed entrance is desirable not only because it has the capability to reduce the effects of the explosion, but also because it facilitates crisis management. However, the execution of an entrance above ground level reduces the effects of blast waves.



Figure 16. The main entrance of the central library of Tabriz

Conclusion

The observation of the necessities of passive defense from the standpoint of civil engineering, architecture and civil planning leads to the reduction of vulnerability of the structure, facilities and human casualties. Therefore, knowing these necessities and subject 21 of the national construction rules is very important. In these studies, added to the introduction of the necessities of passive defense in the above mentioned fields, the amount of the coordination of these rules with the project of the central library of Tabriz was analyzed.

The study results indicated that although the central library of Tabriz is one of the most important centers for storing documents, manuscripts and books, and also the place many people

frequent and work in, the necessities of passive defense have not been observed in this center to a large extent. In the field of civil engineering, the structural system of this center is from armed concrete flexural pans which have a good coordination with the concepts of passive defense. However, no proper plan has been considered for this center. Carrier and guarding walls of the facilities are also not in coordination with principles of passive defense. From the standpoint of architecture, the internal rotation in the space, added elements and decorations, lack of confining the internal parts, the building's exterior and the utilization of glass and cutting element for segregating internal spaces are not in coordination with the principles of passive defense. Civil planning and the environment of this center is proper and access ways, the designing of the ramp and stairs, the use of plant elements and green open spaces, the use of hard material for the center's floor and different guarding shields are among the considered principles of passive defense in this center. Yet still, the neighboring gas station can be counted as one of the weak points of this center in terms of location.

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